THESIS

ORGANIZATION AND MANAGEMENT OF TRACK FORCES

CONLEY

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MANAGEMENT AND ORGANIZATION OF TRACK FORCES FOR RAILWAY MAINTENANCE

By

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This is to certify that the thesis prepared under my supervision by JOHN EDWARD CONLEY Entitled MANAGEMENT AND ORGANIZATION OF TRACK FORCES IN RAILWAY MAINTENANCE is approved by me as fulfilling this part of the requirements for the degree of Bachelor of Science in Civil Engineering.

(Signed) Ira O. Baker

Head of Department of Civil Engineering.

P R E F A C E

The methods described and the opinions expressed in the following article are the result of the writer's experience during more than ten years' actual railroad service in the various positions from track laborer to Road Supervisor.

ORGANIZATION AND MANAGEMENT OF TRACK FORCES FOR RAILWAY MAINTENANCE.

The proper organization and management of forces for maintenance of a railroad is very important, since it facilitates the work, reduces the cost, and lessens the effort required of the foreman in directing the work and of the laborers in executing it. It will not be possible to treat of the organization and management of forces for all conditions that may arise in railway maintenance; but it will be the aim of this article to state the fundamental principles in such a way that they may be applied to any particular condition. It will be assumed that the engineer or roadmaster in charge of the work keeps his foremen properly supplied with tools and material, so that there will be no trouble on that account.

1.- MANAGEMENT OF THE MEN.

This phase of the subject will be considered under three heads, viz.: (1) qualifications necessary for a foreman; (2) relations of the foreman to his assistants; (3) relation of the foreman to the men.

Qualifications Necessary for a Foreman.

A foreman should be a man of good moral character, pleasant to his assistants and laborers, honest and frank, and should combine with these great firmness. He should be a good judge of human nature, and should make this subject one of his principal studies. He should be punctual and demand the same on the part of his men. He should be of neat appearance and keep himself clean. He should not wear overalls or shirts that are tattered or torn, since a small

additional expense on his own clothes will encourage his laborers to be cleaner and neater, and thereby present a better appearance and add to the pleasure and comfort of all parties. However, the other extreme, being too dressy, should not be indulged in, since it causes the laborers to lose their respect for the foreman.

A good foreman should be agreeable with other foremen with whom he comes in contact, for by so doing he may stimulate a spirit of comradeship which may be both beneficial and agreeable. By conversing with other foremen about their respective work, he may add much to his own knowledge. In his intercourse with other foremen he should be courteous and make due allowance for different points of view.

The foreman should be a man of some intellectual ability, and should be a student; for he has charge of complicated switch and signal applicances and is required to maintain the track at a high standard, and unless he is a student he can not keep up with the modifications and improvements introduced from time to time. Further, he must be able to thoroughly understand the rules governing trackwork and also those relating to the movement of trains. He should fully understand all the signals employed in the train service. He should understand and be up to date on the time card. It is absolutely necessary that the foreman should have good hearing and good vision, and particularly that he should be free from color blindness.

If in charge of a section of track, he should personally inspect it each alternate day, and send a track walker over it each intermediate day. He should have a knowledge of the capacity of all water ways in his district; and should have such a knowledge of bridges and masonry as to be able to make a reliable report upon

their strength and safety. The foreman should conscientiously patrol his district during heavy storms; and should at all times keep all material under his charge well cared for. All tools should be kept in first-class condition; and the proper kind and quantity of tools should be kept on hand to do the work required, and particularly he should see that the men take with them the tools required to do the work planned for the day.

The foreman should see that all tool houses are neat and clean. He should also see that boarding cars (if used) are kept scrupulously neat and clean and well ventilated, since carelessness in this respect is the cause of more sickness than all other elements combined. When men are boarded by the company or private contractors, in boarding cars or camps, he should see that the men are given clean and wholesome food. Where the company or individuals keep a commissary car, he should familiarize himself with the goods and prices, and demand justice for his men, and should his men object to trading at the car he should not try to coerce them to do so. He should have no interest in the commissary car nor allow himself to be unduly influenced by any man or company who runs the car. It takes considerable nerve for a foreman to make the above demands, but if he has proof that it is not being rightly run, he should not be afraid of exposing any unjust methods; and his motives will always be upheld by his immediate superior.

Relation of Foreman to his Assistants.

If the foreman is allowed an assistant foreman, he should choose him, if possible, from among his own men; and not allow himself to favor relatives or others in preference to a worthy laborer, since by so doing he will encourage his men to greater efficiency

with the hope of promotion, and will show them that he is actuated by a sense of justice.

He should maintain intimate relations with his assistant foremen, and should explain to them his desires so that they may carry them out satisfactorily. The foreman should cultivate the art or knack of relieving his own responsibility by calling on his assistant foremen, which not only increases the efficiency of his assistants, but also allows the foreman more time for more important duties. If the foreman holds his assistants responsible for results, he should as far as possible give them laborers who are satisfactory; and he should discuss with them all subjects pertaining to the discipline of the men. During the progress of the work the foreman should take note of any errors of the assistant foremen in matters of discipline, and should privately instruct them in better methods or reprimand them if the error was inexcusable. All reprimands should be as short and concise as possible, and still be as courteous as the circumstances will warrant.

Relation of the Foreman to the Laborers.

In hiring laborers a foreman can not always be as particular as he would like, as it is sometimes necessary to take any kind of men he can get, particularly as the wages are low and the work hard and monotonous. In making up a gang of men it is always expected that some will be agitators, some incompetent, and some lazy. The best judgment possible is needed to organize men of this class into an efficient gang. The foreman can add greatly to the efficiency of the gang by properly placing the different laborers. For example, if a lazy man is placed between two active workers, he must keep up or become conspicuous for his failure to do so. Again, a

man should be set to do the class of work at which he is most expert. In all this the foreman should seek to treat the men fairly, and if there is a particularly disagreeable job he should see that all take turns at it. Above all, a foreman should have no pets nor show any favors to any one, except of course to favor a man temporarily injured or one who has grown old in the service.

The foreman should pair his men off so that each man and his partner are congenial, since the men are then more likely to be contented and efficient. In placing the men, it is not wise to allow too many of one family or of one nationality in the same squad. Attention to the above matters will prevent or greatly reduce the tendency to strike. The most exacting and unreasonable laborers respond quickly, or at least ultimately, to wise and judicious management.

The foreman should be quick to take in new situations, quick to plan ways where difficult tasks are at hand. When planning work for his men, he should plan methods of carrying it out by the use of mechanical devices that can be made on the ground or be obtained quickly.

The foreman should know his men by name, and on meeting them in the morning should have a "Good morning" for all and should recognize the good qualities of each without condescending or patronizing them too much. In this way he presents an example to them to be courteous to each other. He should make it evident that he desires this on their part, by mild reproof if necessary. In addressing his men he should call them by their given name or surname, but should never use nicknames or permit his assistants to do so. Owing to this example, he or his assistants will rarely, if ever, be

called by any nicknames; and if through ignorance a laborer does address his foreman in an improper manner, he should be corrected kindly, but firmly. The foreman should show his men by his manner that he has confidence in them. and should avoid showing any suspicions until they can easily be proven. In a reserved but appreciative manner he should notice all good qualities in the laborers. He should develop in them confidence and security of their retention. "The foreman has always stood by me and I will stand by him" is a good strike preventive. With tact and good judgment he can develop a gang of loyal men who will obey and respect him.

A foreman before reprimanding a man should be careful to know that he is right and that the man is in the wrong. However, should he make an error of this kind he should acknowledge his mistake to his men and not try to carry a high head and say nothing about it, just because he has a little authority. He should never curse or swear at his men, since kind words will accomplish more. He should be careful in condemning or reprimanding a laborer for failure to work on Sunday on account of religious scruples. It would be better to overlook it altogether. However, when it is very necessary that he work his forces on Sundays, as in case of a wreck or washout, he should have such control of his men that they will respond to his call. The foreman should discharge the agitator who tries to talk a gang of men into refusing to work on such occasions, when he reported for work on the following day; and he should also give the rest to understand that their services were not wanted unless they were willing to work in emergencies of this kind. If the foreman thinks it possible to hire a new gang in the vicinity in a short time, he should insist that all who refuse to work in an emergency should hunt work elsewhere. Tact and good judgment are required in

cases of this kind, in order to keep a full gang and at the same time uphold his name in the vicinity and his authority with his men.

The foreman should recognize his men whenever he meets them outside of working hours and should be cordial, but avoid familiarity. Above all, he should avoid drinking liquors with them, as nothing is more sure to breed contempt and cause the laborer to lose his respect for the foreman.

The chances are that in the future it will be necessary to employ negroes, Italians, or Greeks, for all gangs of any size, as it is hardly possible to get enough Americans for section forces at the present time. To handle the above classes of men, the best foreman on a division is chosen. To successfully manage a large gang of negroes, the foreman should be a strong man, firm in his demands, and a hustler; for if he can not get the negroes out of their sing-song southern ways into quick methods of doing the work, it is not likely that he will be successful. If a gang of colored men find out that a foreman is timid and slow, it is almost certain that they will try to bluff him, and be slow in executing the work and become very talkative among themselves. If they even start the latter evil, it is very likely that the foreman will have all he can do to manage them. He can break this up easiest by arranging his work so that they will be more or less on the move. For example, if he had a large gang of men spiking new track, instead of giving each spiking gang a large section of track to spike up, he should space small squads one or two rail lengths apart and have, say, each gang spike each fifth rail or each fifth pair of rails, etc. This class of men has a tendency occasionally to lay off a day, and many will not report in the morning until after the work commences. To stop this

it is necessary to discharge offenders of either kind. While it is true that when they work steadily they stay only a short time in a place, it is better to make them work steadily or leave; because if a few lie around the camp or boarding cars, they entice others to stay with them and it often happens that when the evil is not checked promptly more of them are laying off than are working. When working colored men the foreman should make arrangements to have his gang replenished from time to time as necessary. He should not allow them to carry concealed weapons of any kind. Discharge a man as soon as it is learned that he carries weapons. By careful culling, a foreman can often pick a gang what will work steadily and well, if properly managed.

The handling of Greeks and Italians is harder than that of negroes. The former are generally steady workers, but on track work or in laying steel they will not accomplish as much by twenty per cent as an equal number of colored men. It is almost impossible to discharge a Greek or an Italian without losing the whole gang, as they will stick together; and often one hundred will leave, owing to the discharge of only one of their number. If a foreman desires to get rid of only a few of this class of laborers, he must do it by some indirect means. The following is one method that has been employed. The railroad company usually furnishes boarding cars for the men and generally there is plenty of accommodation for the gang. The foreman can assign a few of the least desirable men to a particular car and send that car to some distant point, preferably toward the redesvous of that class of labor (usually a large city), which place it will be easier for them to reach than to return to the original gang. Then if the new foreman discharges one of them and they all leave, the desired result is accomplished with a loss of

only a few men. In making this move, the first foreman should arrange with the transportation department to have some through night train pick up the desired car, so that they will be properly treated while in transit.

The foreman should not allow any interpreter on the work; even if it does retard the work a little at first. An interpreter is generally an agitator, and can cause a foreman unlimited trouble. With good assistants, a foreman can handle this class of labor with better satisfaction than if he employes interpreters. The foreman will find that it is necessary to keep this class of men at the same kind of work, and also to so arrange the work that one squad must keep out of the way of the next. When the squads are thus arranged the foreman should instruct the first squad as to the best and easiest way of doing the work, and encourage them until they have attained a reasonable speed, after which he should take each succeeding squad in hand in a similar way. The foreman should endeavor to have all parts of the work proceed smoothly and at a satisfactory rate. If laborers of this class are kept for some time at exactly the same kind of work and are properly instructed, they will accomplish more in surfacing track and ballasting than an equal number of colored men organized in the same way.

There is another class of labor to manage which requires great skill and watchfulness on the part of the foreman. In any considerable gang of railroad workers there is likely to be a number having a restless, roving disposition. They come from nearly all classes of people, and in many cases have had no restraining influence at home, and oftentimes have no home at all. They have no fear of being discharged, and work only long enough to earn what is necessary for their mere existence. With this kind of men rules or exacting

methods are practically useless, and a foreman will be continually changing the men, owing to their carelss and wandering ways. Good judgment on the part of the foreman in hiring men will greatly lessen his troubles with this class and also materially increase the amount of work accomplished by the gang.

Finally, a foreman in his treatment of the laborers should be strictly honest toward his own employers. He should not allow pay to a man (no matter how good) for any time that he did not work; because if the foreman should reward a man in this way once, he will likely ask greater favors in the future. If a foreman thinks a man worthy of better wages, he should ask his superior to promote the man or raise his wages. The foreman should avoid holding wages or assisting merchants to collect money from men working for him. Let the merchant handle this matter himself. However, should a merchant speak to the foreman about matters of this kind, he should be advised to speak to the laborer and tell him what he intends to do about the matter. Many such cases can be settled in this way.

If the foreman should receive orders to reduce his forces, he should have consideration for good men, particularly if it is not likely that they can get work elsewhere. FOrexample, if a section foreman who is employing six men receives an order to reduce his force to four men, he should divide the work among the six rather than discharge two. But in this distribution he should regard the relative needs of the several men. A section foreman should be liberal to his men in giving them discarded material, such as old ties, pile heads, and old planks. If the company permits gardening on the right of way, the foreman should encourage his men to cultivate part of it; but a foreman should not allow pay to a laborer for time he works in his garden.

There is no theory of the control and management of men that is perfect, and there will always be opportunity for the foreman to exercise tact and good judgment.

II. ORGANIZATION OF FORCES.

A proper organization of the forces is of the utmost importance, since often a different arrangement of the men will add from 10 to 25 per cent to the amount accomplished, and in extreme cases 50 to 100 per cent. In starting a new piece of work the foreman should first direct his attention to the organization of his forces to secure the greatest possible efficiency.

A few examples will be given of the organization that has been found satisfactory in those kinds of work occurring most frequently.

Unloading Ties.

Although the unloading of cross ties or fence posts is in itself a simple operation, a proper organization of the work may greatly decrease the cost of train service and distribute the ties so as to decrease the cost of subsequent operations. The foreman should assign at least two men to each car of ties and not more than six, since a greater number are in each other's way. The number of men to be assigned to each car will depend upon the number of cars of ties to be unloaded and possibly upon the time between regular trains. The foreman should provide the men on each car with a list showing the number of ties needed between successive telegraph poles on each half mile of track; and he should also instruct the locomotive engineer to sound the whistle at each mile and half mile; When the train is ready to start the foreman takes his place upon some car where he can see the ties as they are unloaded and where he can be seen by the locomotive engineer. The foreman then by signals to

the engineer gages the speed of the train so that the proper number of ties are thrown off between successive telegraph poles.

For example, if a train of fifteen cars of cross ties is to be unloaded and forty-five ties are required to each space between successive telegraph poles, then the men should throw out three ties to each space until the engineer signals that the second half mile has been reached. The men unloading ties then examine the list to see how many ties are to be thrown out for each space of the second half mile, and so on until the whole train is unloaded. If this method is properly explained to the laborers and to the locomotive engineer, the ties can be unloaded more quickly and more uniformly than by any other method.

The above method is most successfully operated when all the cars contain the same number of ties. If the number of cars to be unloaded is very great and the number of ties per car varies considerably, the foreman may be justified in sorting the cars to secure uniformity; but this process would not be justifiable if the number of ties per car differ only slightly, since it is better to waste the time of three or four men on a car than to delay the whole work-train to switch the cars.

Unloading Rails.

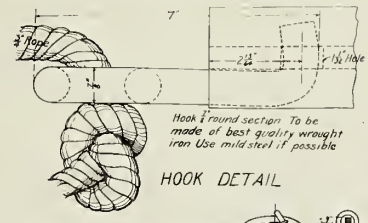
Undoubtedly the best method of unloading rails is with a Sheahan rail unloader. Fig. 1 is a diagram showing the essential features of this machine. It consists of an ordinary rubble or push car upon which is bolted a 10" x 18" timber 8 feet long. The timber is perpendicular to the track and is fastened just behind the front exle. Upon the timber is spiked a light T-rail about 8 feet long. Another piece of light T-rail about 16 feet long, bent in the form of a V, is fastened with the apex at the center of the top side of

FIG I

SHEAHAN'S RAIL UNLOADER

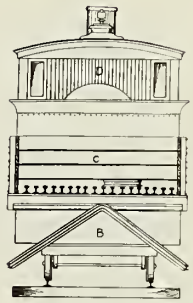
EXPLANATION

1. Pine block bolted crosswise on push car.
2. " " " " " "
3. " " " lengthwise on center of push car with hole for coupling pin in front end.
4 & 5. Lugs riveted to the bottom of 9 to fit against 2.
6. Lugs for fastening 9 to 1.
7. A long coupling pin.
8. Cross rail fastened to 1.
9. V-shaped rail fastened to 1 and 2.
8 and 9 made out of 25 lb. iron rails



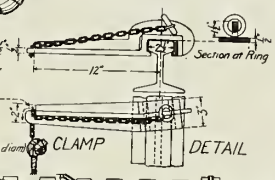
Hook 1" round section. To be made of best quality wrought iron. Use mild steel if possible.

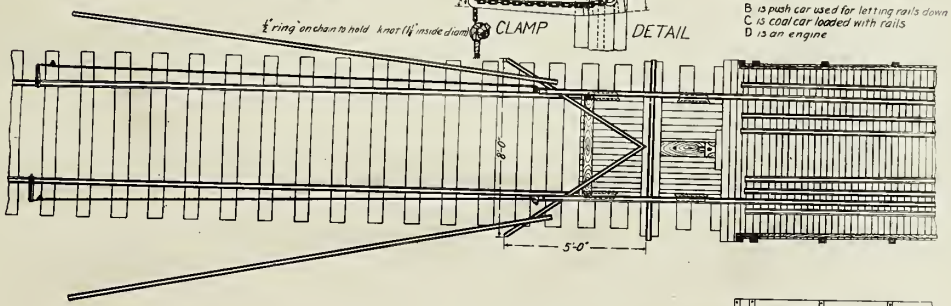
HOOK DETAIL

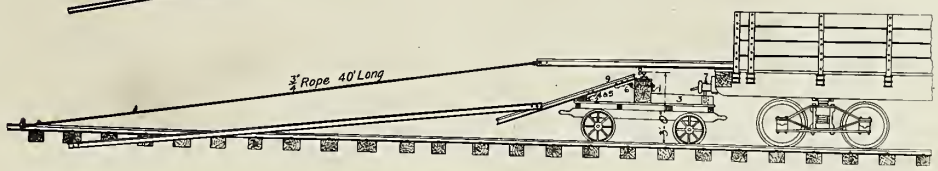


B is push car used for letting rails down
C is coal car loaded with rails
D is an engine

For clamp use steel T (as Carnegie T 6 13 3 x 1½). Shear stem & forge to shape to fit 75 lb. rail closely & be hinked enough to be used on a 2" head. Chain to be ¾" & 2' long. In case rope remains under tension after the rail falls more chain over end.







PLAN AND SIDE ELEVATION SHOWING UNLOADING OPERATION

the timber, the free ends of the V projecting outward and downward at the back of the push car. Accompanying the rail unloader are four ropes about 40 feet long with a right-angled hook at one end and a clamp at the other. The hook is used in hitching to the rail to be unloaded, and the clamp is used in anchoring the outer end of the rope to the rail in the track.

To use the Sheahan unloader, the push car is coupled to the car carrying the rails, the hooks on two of the ropes are passed through the holes in the ends of two of the rails, and the rear ends of the ropes are made fast at the joints of the rails in the track, one on each side of the track. The train then moves forward steadily and continuously at about one mile per hour, and the rails are dragged endwise from the back end of the car. When the rail is about half way off from the end of the car, the man who previously attached the hook pushes the end outward so that it will fall outside of the track. When the rear end of the rail leaves the car, it first falls upon the T-rail on the rail unloader, and then upon the inclined side of the V-rail, down which it slides until it falls outside of the rail in the track. When the first rail is about one quarter to one third of the way off, the hooks of the other two ropes are fastened to another pair of rails, and the rear ends of the ropes are attached to the next succeeding rail joints, and the result is that about the time the first rail drops, a second begins to drag off the car, and thus two strings of rails, one on each side, are continually leaving the car. With this device eighty 85-pound 30-foot rails have been unloaded in six minutes.

To unload rails with this machine when the rails are loaded in the usual way for new rails, i.e., in layers, the ball in the lower layer being up and in the upper layer being down, sixteen men are

required, distributed as follows:-

1 foreman in charge

2 men in the car to loosen and guide the rails

2 men on the unloader to attach the hook

8 men on the ground handling the ropes and clamps

2 men on the ground to place the rails right side up and clear of the track

1 water boy

If the rails are shipped in open coal cars or on flat cars, the two men in the car can be dispensed with; but if the rails are piled promiscuously on the car, two or three more men may be required.

Relaying Rails.

A very good method of relaying rails is to replace one rail at a time, in which case the following distribution of forces will give very satisfactory results:-

1 foreman

2 men attaching angle bars to the new rails to be laid. The angle bars should be attached only by one bolt in the second hole, in which case the angle bars will serve to guide the rails into place while it is being laid in the track.

2 men adzing ties preparatory to laying the new rails

1 man adzing ties at the joints as the rail is being placed in track

14 men with claw bars pulling spikes

1 man with spike maul to drive down broken spikes

4 men with lining bars throwing out old rail

16 men with tongs placing new rails

4 men bolting up joints

2 men nipping the new rails into place.

10 men spiking

2 men flagging

2 assistant foremen

1 water boy

62 total.

In case the placing of new rails is delayed by the preparation for the passage of trains, the men employed in pulling spikes, throwing out old rails, placing new rails, etc., should fall back and help spike and bolt up the rails already laid.

If the rails are laid in sections or strings of from 20 to 100 rails on a side, the following organization will give good results:-

1 foreman

2 men adzing

2 men putting on angle bars ahead (one bolt in second hole to guide the rail)

16 men with tongs laying up rails (85# ballasted track)

4 men bolting up

1 man distributing bolts and nut locks

1 man pulling spikes where new joints are to come

1 assistant foreman

1 water boy.

In laying the rail in track, the gang should be arranged as follows:-

1 foreman

2 men flagging

1 man adzing ties for new joints

8 men with claw bars pulling spikes

4 men spiking

3 men throwing out old rails.

2 men putting in new rails

2 men nipping new rails into place

1 man spiking joints and centers

1 man with supply car which carries connection outfits, spikes, bolts, etc., who also acts as water boy

3 men throwing old rail outside of track

1 assistant foreman.

Ballasting.

For ballasting track where the material is unloaded from Rodger ballasting cars, the following method gives good results:-

2 men digging holes at joints and centers for track jacks

4 men handling track jacks

12 men tamping (6 on each side with picks, tamping outside of the rails)

1 man with level boards

12 men tamping between the rails

10 men dressing track

2 men tightening up spikes and gauging

1 water boy

2 assistant foremen

Total 46, not including the foreman.

The tampers should be placed so that each man has three ties to tamp, and the same man should always tamp the same three ties under each rail. Poor tamping can then be traced to the one who did it. Again, each man should tamp the north one of his three ties first if the gang is going north, so that the men will not be in each other's way when nearly done. The four men who handle the jacks should also be required to space and straighten the ties.

Incidentally, it may be well to mention that the bars used in

spacing ties should also be employed as handles in operating the track jacks, thus obviating the necessity of carrying the wooden handle ordinarily furnished with the jack.

Laying a Ladder Track

Before beginning the work the foreman should determine the proper lengths of rails required in the outer rail of the ladder track to prevent joints coming at or near the switch points. These rails are carried and laid end to end about two feet outside of its final position. Marks are then placed upon this line of rails to show the position of each head block and also the center of each switch tie in each switch, as shown or called for by the book of rules. The head block should be numbered 1 and the successive switch ties 2, 3, etc., to the last switch tie in each switch. If the length of each switch tie is not already marked upon its end, the foreman should have them so marked. If any ordinary cross ties are required between switches, the position of each should be indicated by a mark; but it is needless to number these marks, since all such ties are the same length. Undoubtedly the foreman will be provided with a book of rules which states the number, length and spacing of the ties in different switches. Fig. 2, page 20, shows, for example, the position of the ties in a switch having a No. 7 frog. In the figure these ties are numbered consequtively, beginning with 1 at the head block. From Fig. 2 or its equivalent, the foreman prepares a list similar to Table I, which shows the position in Fig. 2 of the several lengths of switch ties.

Tables II and III show the position of ties for the switches having a No. 10 frog, and a slip switch having a No.7 frog, respectively.

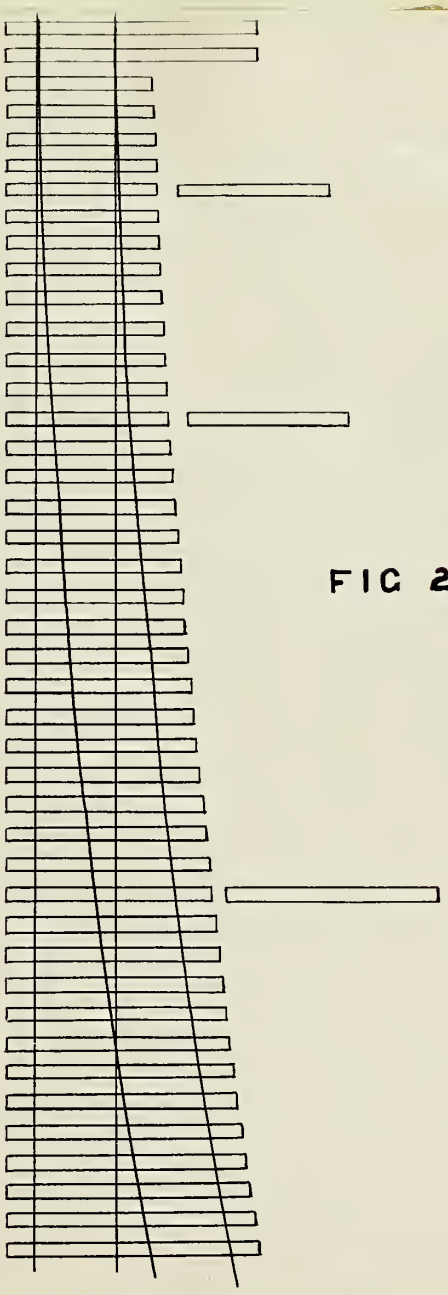


FIG 2

T A B L E I.

Position of Ties for a Switch having a No. 7 Frog.

Ref. No	Length of Tie		Number to designate Position of Tie in Fig. 1
	Feet	Inches	
1	8	0	3, 4, 5, 6
2	8	6	7, 8, 9, 10, 11
3	9	0	12, 13, 14, 15, 16
4	9	6	17, 18, 19, 20
5	10	0	21, 22, 23, 24
6	10	6	25, 26
7	11	0	27, 29, 29
8	11	6	30, 31
9	12	0	32, 33
10	12	6	34
11	13	0	35, 36
12	13	6	37, 38
13	14	0	39
14	14	6	40, 41
15	15	0	42, 43
16	15	6	44, 45
17	16	0	46, 1, 2

T A B L E II.

Position of Ties for a Switch having a No. 10 Frog.

Ref. No.	Length of Tie		Number to designate tie in a diagram similar to Fig.1
	Feet	Inches	
1	8	0	3, 4, 5, 6
2	8	6	7, 8, 9, 10
3	9	0	11, 12, 13, 14, 15,16, 17
4	9	6	18, 19, 20, 21, 22, 23
5	10	0	24, 25, 25, 27
6	10	6	28, 29, 30
7	11	0	31, 32, 33, 34
8	11	6	35, 36, 37
9	12	0	38, 39
10	12	6	40, 41
11	13	0	42, 43, 44
12	13	6	45, 46
13	14	0	47, 48, 49
14	14	6	50, 51
15	15	0	52, 53, 54
16	15	6	55, 56, 57
17	16	0	58, 59, 60, 1,2

T A B L E I I I.

Position of Ties for Double-Slip Switch with No. 7 Frogs and 8-foot Ties.

Spacing 22" Center to Center.

Ref. No.	Length of Tie		Number to designate tie in a diagram similar to Fig. 2
	Feet	Inches	
1	10	6	21,22,24,25,31,32,33,35,36
2	11	0	18, 19, 38, 39
3	11	6	17,40
4	12	0	13,14,23,27,30,34,43,44
5	12	6	11,12,20,37,45,46
6	13	0	9,10,15,16,26,28,29,41,42,48
7	13	6	7, 8, 49, 50
8	14	0	5, 6, 51, 52
9	14	6	4, 53
10	15	0	2,3, 54, 55
11	15	6	1, 56

Ties Nos. 15, 28, 29 and 42 to be turned on edge if interlocking apparatus is applied.

All things are now ready to begin the distribution of the ties. The foreman should provide himself with as many copies of Table I, for example, as there are switches in the ladder track, and each should be numbered to correspond with the switch. The laborers pick up the most convenient tie, and as they pass by the foreman looks at the number on its end giving its length and tells the number of the switch and the number on the rail opposite which the tie is to be laid; and he also crosses off in the proper copy of Table I the number so designated. For example, the right hand side of Fig. 1 shows three ties in position, numbered respectively 7, 15, 31. These numbers in Table I are crossed off to indicate the ties in place. It is assumed that tie No. 7 was exactly 8' 6" long and that tie No. 15 was 9' 4" long and that tie No. 31 was about 11' 8" or 11' 10". It will be noted that the ties are so placed as to make the alignment of the ends of the ties on the side-track side practically parallel without cutting off the ties. Substantially the above method of distributing the ties may be employed if the inside ends of the ties are afterward to be cut off to line.

Table I may be used in a somewhat similar way in loading or unloading switch ties, as a convenient method of determining when a complete set has been loaded or unloaded.

Laying Sidings.

No particular attention need be given to the organization of forces for laying the ties, since any number of men can be put at this kind of work. For example, two or four men can be set to spacing the ties between two consecutive telegraph poles. The proper distance between center of ties can be determined by using a rod of length equal to that of the rail, or the position of each tie may be

indicated by a wheel of proper diameter having projections on its perimeter which make indentations on the ground as the wheel is rolled along.

In laying the rails the following organization of forces has been proved to be effective:

OCCUPATION	No. of Laborers on the Gang			
	75	100	110	125
MANAGEMENT				
General Foreman	1	1	1	1
Foreman		1	1	1
Assistant Foremen	2	2	2	2
LABORERS:				
Putting on angle bars with one bolt	2	3	3	3
Laying up rails	12	14	16	16
Distributing bolts and nut locks	1	2	2	2
Bolting up	4	7	8	10
Taking out expansion shims	1	1	1	1
Spacing ties and placing joint ties	7	8	10	12
Distributing spikes	1	2	2	
Spikers and Nippers (line side)	21	27	30	33
" " " gaging	6	12	12	15
" " "full spiking gage side	12	15	15	18
Tightening bolts after spiking	1	2	2	2
Digging out and planking public and private crossings	5	6	7	9
Water boys	1	1	2	2
Total No. of Laborers	75	100	110	125

Clearing up Wrecks.

Of necessity quick work is required at wrecks, and in this work a competent foreman who has properly trained his men may make a valuable reputation among his superior officers, since they are sure to watch the results accomplished in such cases. Such work tests the training and discipline of the laborers; and the foreman, whose men are not afraid of work and who, for example, can cut a rail in less than a minute and who are good spikers and quick splicers, has an opportunity to make an enviable record.

The foreman when called to a wreck should take good tools with him, and he should see that they are properly marked, so that he can identify them when collecting them to leave the wreck. He should make a memorandum of the tools he takes, so that he may know when all have been returned.

The foreman should be very careful for the safety of his men, in no case taking any chances. For example, he should keep the men at a safe distance from chains and cables when under stress; and in raising a car with jacks he should see that the blocking is placed so as to catch the car and protect the men in case a jack slips.

If the foreman's superior officer can not reach the wreck in seasonable time, and the foremann is instructed to take charge of the work, he should carefully consider the best means of providing for the passage of trains, particularly fast ones. In any case there are only four methods of getting trains by, viz.: (1) putting the wrecked cars on the track and taking them to a near-by siding; (2) rolling or pulling the wrecked cars away from the track to clear it; (3) building a new track around the wreck; (4) sending the traffic around by other roads until the first method above can be applied. If the wreck occurs in a deep cut or a tunnel, or the wreck destroys a

bridge, the fourth method must be applied.

If material be scarce and it is necessary to build a track around the wreck, it may be permissible to go to a siding, take up the track in sections and use it in laying a temporary track around the wreck. Under some circumstances it might be possible to slide the sections of the track onto the main line with lining bars or otherwise, and push them with a locomotive to the wreck. If there is more than one side track, it may be possible to pull a section of one side track upon the main track and then run the engine around the section and push it to the wreck. On arriving at the wreck the locomotive may possibly be utilized in pulling the section into place in the temporary track. If for any reason it is impossible to drag a section of track into place on the ties, turn the section of track upside down and slide it into place on the rails and then turn it right side up. Of course a foreman should secure proper authority before thus tearing up track, and even then he must use good judgment as to the track to be taken up, and certainly should not destroy the only passing or storage track near the wreck.

III. OFFICE WORK OF THE FOREMAN.

A foreman should have a desk for his papers, with suitable compartments for reports, stationery, etc. He should always keep a supply of necessary blank reports. He should keep a day book in his pocket and record each day the time put in by each man, the kind of work done, and the amount of time to be charged to each class of work. He should also record daily the amount of material received and the amount used, taking particular pains to record the dates accurately. He should also make note of any material that would be of further use for sidings or other places. He should be prompt with

all his reports, and if proper records be kept he will always be able to reproduce them in case of loss or miscarriage. These reports should be made with copying ink or copying pencil, so that his immediate superior can keep a copy of them as they pass through his office.

The foreman should be particular to make telegraphic reports of wrecks, switches run through, personal injury cases, etc., concise but comprehensive. The following are a few examples of such telegrams and may perhaps serve as a guide in preparing others:-

Message concerning Wreck.

Filed 4:30 p.m.

Tolono, Ill., 5/12/03

Jno Doe (Roadmaster), Chicago

W. A. Ide (Supervisor), Kankakee.

Train No. 10, Engine 829, south bound, derailed near trucks of engine tender and three cars next to engine, 1600 feet south of mile post 140. Ran 400 feet on the ties, broke 200 spikes, 20 bolts. Caused by broken rail. Time 4:20 p.m. Will take about 2 hours to clear track.

W.C. Day (foreman).

Message for Switch run through.

Tolono, Ill., 5/12/03.

Jno. Doe (Roadmaster), Chicago

W. A. Ide (Supervisor), Kankakee.

Engine 481 of train 91, going south on passing track, ran through south passing track switch. Broke left-hand point and twisted switch staff. Cost of labor to repair damages, $5.00.

W. C. Day (foreman).

Another form where it is not known what train ran through switch:-

Some train, engine unknown, going south on main track ran through south house-track switch some time last night. Broke connecting-rod bolt and twisted switch staff. Cost of labor to repair damages, $2.50.

W. C. Day (foreman).

Message for Personal Injury Report

John Doe, laborer section 34 for past three years, married, 29 years old, had his right eye put out by a piece of steel from chisel at 9:30 a.m. today while striking chisel with sledge. Accident occurred at north house-track switch at Savoy. Dr. Wayne was called at my request. Injured man is in critical condition.

W. C. Day.

Message in Case of Trespass on Company's Property

John Doe, grain merchant at this place, commenced to erect a new engine house at south side of his elevator this a.m. without proper authority. I notified him to stop the work at once and to request permit to do the work. What is your pleasure in this matter?

W. C. Day.

Message in Case of Washout.

Culvert one mile north of Tolono was washed out by high water last night. Track not safe for trains. Thirty feet of track to be repaired and eight feet of filling to be done.

W. C. Day.